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ABSTRACT

A study examined the factors determining the learning environments of agricultural science classes in Nigeria and the effects of those learning environments on student attitudes and achievement. The study sample, which was selected to be representative of schools from Nigeria's northern and southern regions and urban and rural areas, consisted of 1,175 students in 50 secondary-level agricultural science classes in 20 different schools located in 8 states. The "Constructivist Learning Environment Survey" (CLES) and "Individualized Classroom Environment Questionnaire" (ICEQ) were used to determine student perceptions of classroom environment, the "School-Level Environment Questionnaire" was used to identify teacher perceptions of school-level environment, and the "Test of Enquiry Skills" and "Test of Related Science Attitudes" were used to measure student achievement. Analysis-of-variance, simple correlation, and multiple regression analysis were used to analyze the various data. Higher scores on the negotiation, autonomy, investigation, and differentiation scales of the CLES and ICEQ were associated with more positive student attitudes and higher enquiry skill scores. All five dimensions of school-level environment (affiliation, professional interest, participatory decision making, innovativeness, and resource adequacy) had a significant effect on classroom-level negotiation, autonomy, and investigation. (Contains 26 references.) (MN)

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Determinants and Effects of Learning Environments in Agricultural Science Classrooms in Nigeria

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Although the study of learning environments has spanned many different countries, this line of research has been almost nonexistent in Nigeria, with the only three examples of prior studies being a cross-national study of science laboratory classroom environment settings (Fraser, Okebukola & Jegede, 1992), a study of the socio-cultural environment (Jegede, Fraser, Agada & Okebukola, in press), and an investigation of associations of student attitudes with classroom and school psychosocial environment (Akindehin, 1993). Recent literature reviews (e.g., Fraser, in press; Fraser & Walberg, 1991) suggests that previously no learning environment study has been conducted specifically in agricultural science classrooms in any country.

Background

Nigeria lies wholly within the tropics along the Gulf of Guinea on the western coast of Africa between latitude 4 degrees and 14 degrees north of the equator, and 3 degrees east of the Greenwich Meridian. The country is bounded on the west by the Republic of Benin, on the north by the Niger Republic, on the east by the Republic of Cameroon, and on the south by the Atlantic Ocean. It occupies a land area of about 923 773 square kilometres. Nigeria's mean annual rainfall figures range from 300 millimetres at the sahel savanna zone to 3 000 millimetres at the mangrove forest zone, and significantly determine agricultural practices in the vegetation zones. Nigeria's average temperature is 32 degrees Centigrade.

The total population of Nigeria is over 88 million, with approximately 75% of people living in rural agricultural communities. Agriculture has been the mainstay of economic development in Nigeria since independence in 1960. With the first development plan (1962-1968) and the second development plan (1970-1974), the agricultural sector accounted for two thirds of the national gross revenue. From 1975, oil revenue exceeded that of agriculture and became the main source of Nigeria's revenue. However, current government policy has shifted again towards the agricultural secor. Within this context, it is not surprising that agricultural science occupies a central place within school curricula in Nigeria, and that it is a compulsory subject for all secondary school students.

The school agricultural science curriculum is structured around the three major concepts of production, protection and economics, with topics classified as basic concepts, crop production, animal production, agricultural ecology and systems, agricultural engineering and agricultural economics. Despite agricultural science's pride of place, research has suggested that Nigerian students often have negative attitudes to the study of agricultural science and low levels of achievement in it (Idiris, 1988, 1990; Mohapelon, 1973; Olaitan, 1984). Consequently, the present study of the learning environments of Nigerian agricultural science classes, their determinants, and the effects of these environments on student attitudes and achievement, is timely and important.

Aims

The aims of the present paper are to report:

1. the development and validation of a classroom environment instrument specifically suited to assessing the emphasis on constructivist and individualised approaches in secondary school agricultural science classes in Nigeria.
2. an investigation of the effect of classroom environment on students' attitudes and inquiry skills.
3. a study of some determinants of classroom environment (especially, the school-level environment).

Method

Sample

The sample consisted on 1 175 students in 50 junior secondary and senior secondary agricultural science classes in 20 different schools in 8 states of Nigeria. The sample was representative of schools from the northern and southern regions, and of urban and rural areas.

Instruments

Student perceptions of classroom environment were assessed with an instrument which initially encompassed the four scales of Negotiation, Prior Knowledge, Autonomy, and Student-Centredness from the 1991 version of the *Constructivist Learning Environment Survey* (Taylor & Fraser, 1991) and the two scales of Investigation and Differentiation from the Individualised Classroom Environment Questionnaire (Fraser, 1990). However, the Prior Knowledge scale was dropped following item analysis procedures. Each classroom environment scale was amended to maximise its suitability for use in agricultural science classes in Nigeria.

Teachers' perceptions of school-level environment were assessed with a version of the *School-Level Environment Questionnaire* (Fisher & Fraser, 1991; Rentoul & Fraser, 1982) which had been adapted somewhat to enhance its suitability for use in Nigerian secondary schools.

Student achievement of enquiry skills was assessed with a 15-item instrument based on the *Test of Enquiry Skills* (Fraser, 1979), while the assessment of students' attitudes towards the learning of agricultural science involved 23 items adapted from the *Test of Science Related Attitudes* (Fraser, 1981). For the present sample, the alpha reliability coefficient for the inquiry skill measure was 0.66 and 0.87, respectively, with the individual and the school mean as the unit of analysis. The corresponding reliability figures for the attitude instrument were 0.63 and 0.83, respectively.

Analysis

In order to validate the classroom environment instrument for use with Nigerian agricultural classes, item and factor analyses were conducted. A series of analyses of variance was carried out in order to find out if the actual version of each scale was able to differentiate significantly between the perceptions of students in different schools.

To investigate the relationships between classroom environment perceptions and student outcomes, two main methods of analysis were used: simple correlational analyses of relationships between individual outcome scores and individual environment scales; and multiple regression analyses of relationships between each outcome scale and the set of environment scales as a whole. All analyses were conducted once using the individual student score as the unit of statistical analysis, and repeated using the school mean as the unit of analysis.

The investigation of associations between classroom-level and school-level environment involved simple correlations between school means of student perceptions on five classroom environment variables and school means of teacher perceptions on seven school environment dimensions.

Cross-Validation of the Classroom Environment Instrument

Table 1 reports validation information for both the actual and the preferred forms of the classroom environment instrument based on its use in Nigeria. The alpha reliability coefficient was used as the index of scale internal consistency, while the mean correlation of a scale with the other four scales was used as a convenient index of scale discriminant validity. Analyses are reported separately for two units of analysis (the individual student and the school mean). Figures reported in Table 1 generally suggest that each scale has satisfactory reliability for scales containing relatively small numbers of items (from 5 to 8). For example, the reliability of different scales in the actual form ranged from 0.55 to 0.82 with the individual as the unit of analysis and from 0.71 to 0.96 with the school mean as the unit of analysis. As expected, higher reliabilities were obtained when the school mean was used as the unit of statistical analysis. Comparable reliability estimates were found for the preferred form.

The mean correlation of a scale with the other four scales (i.e., the index of discriminant validity) ranged from 0.12 to 0.46 for the preferred form, and was comparable to the actual form. These figures are sufficiently low to indicate acceptable discriminant validity, and to suggest that the instrument assesses somewhat overlapping dimensions of classroom environment.

The analyses of variance reported in the last column of Table 1 confirm that the actual version of each scale differentiated significantly ($p<0.001$) between the perceptions of students in different schools in this sample. The eta^2 statistic (which is the ratio of 'between' to 'total' sums of squares and represents the proportion of variance in scale scores accounted for by class membership) ranged from 0.14 to 0.45 for different scales.

TABLE 1. Internal Consistency Reliability (Alpha Coefficient), Discriminant Validity (Mean Correlation with Other Scales) and Ability to Differentiate Between Schools (ANOVA Results) for the Classroom Environment Scales for Two Units of Analysis

Scale	No. of Items	Unit of Analysis	Alpha Reliability		Mean Correlation with Other Scales		ANOVA Results Eta^2
			Actual	Preferred	Actual	Preferred	Actual
Negotiation	5	Individual	0.55	0.50	0.24	0.12	0.32*
		School Mean	0.71	0.73	0.49	0.31	
Autonomy	7	Individual	0.73	0.60	0.37	0.31	0.45*
		School Mean	0.96	0.91	0.49	0.46	
Student Centredness	7	Individual	0.82	0.59	0.37	0.37	0.14*
		School Mean	0.91	0.74	0.33	0.42	
Investigation	8	Individual	0.64	0.59	0.39	0.27	0.31*
		School Mean	0.94	0.90	0.48	0.43	
Differentiation	5	Individual	0.59	0.50	0.28	0.27	0.16*
		School Mean	0.82	0.75	0.38	0.37	

* $p<0.001$
The sample consisted of 1 175 students in 20 schools.
Eta^2 is the ratio of 'between' to 'total' sums of squares and represents the proportion of variance in scale scores accounted for by class membership.

Factor analyses suggested that the factor structure obtained previously in other nations was replicated to a large extent, with the exception of only a few items, with the Nigerian samples.

Associations between Student Outcomes and Classroom Environment

Table 2 reports associations between the two student outcome measures (namely, enquiry skills and attitudes) and the five classroom environment scales. Analyses were pe formed for two units of analysis, and only statistically significant associations ($p<0.05$) are reported in Table 2. Because the simple correlation analyses are likely to be associated with a relatively high Type I error rate for the study as a whole, stepwise multiple regression analyses were conducted to provide a more conservative test of the associations between an outcome measure and a specific environment scale when all other environment scales preceding it in the stepwise analysis were mutually controlled.

The simple correlation analysis reported in Table 2 shows that the number of statistically significant associations ($p<0.05$) between attitude scores and an environment scale was 4 with the individual as the unit of analysis (16 times that the expected by chance) and none with the school mean as the unit of analysis. For the inquiry skills outcome, the number

of significant associations was 3 with the individual as the unit of analysis (12 times that expected by chance) and 5 with the school mean as the unit of analysis (20 times that expected by chance).

For the stepwise multiple regression analyses, a significant relationship was found between attitudes and Autonomy with the individual as the unit of analysis, between enquiry skills and both Negotiation and Autonomy with the individual as the unit of analysis, and between enquiry skills and both Autonomy and Student Centredness with the school mean as the unit of analysis. As expected, the number of significant findings in the multiple regression analysis was smaller than for the simple correlational analysis.

TABLE 2. Significant Results from Simple Correlational and Stepwise Multiple Regression Analyses for Associations Between Classroom Environment Scales and Student Outcomes for Two Units of Analysis

Scale	Unit of Analysis	Attitude		Enquiry Skills	
		r	*β*	*r*	*β*
Negotiation	IndividualSchool	0.22*		0.45**	0.33**
	Mean			0.79**	
Autonomy	IndividualSchool	0.26**	0.26*	0.59**	0.51**
	Mean			0.72**	0.80**
Student Centredness	Individual	0.24*		0.16	
	School Mean			-0.49*	-0.61**
Investigation	Individual	0.21*		0.50**	
	School Mean			0.56**	
Differentiation	Individual			-0.01	
	School Mean			0.67**	
Multiple Correlation *R*	Individual		0.26*		0.67**
	School Mean				0.94**

* $p<0.05$
** $p<0.01$
The sample size was 1 175 students in 20 schools.

The present results replicate considerable research in numerous countries which has established consistent relationships between student outcomes and student perceptions of the classroom environment (Fraser & Fisher, 1982; Haertel, Walberg and Haertel, 1981; McRobbie & Fraser, 1993). Moreover, with one exception, higher scores on environment scales were associated with more positive attitudes and higher enquiry skill scores. The one exception, in which a negative relationship was found between enquiry skill proficiency and Student Centredness, is consistent with prior research in other countries involving the Student Centredness scale (Fraser, McRobbie & Giddings, 1993).

Determinants of Classroom Environment

Whereas the previous section reported an investigation of the effects of classroom environment on student outcomes, the aspect of the research which is described in this section involved an investigation of some determinants of classroom environment. Although the range of determinants of classroom environment included in the study included student gender, region (north, south), type of school (rural, urban), and the nature of the school-level environment, attention in the present paper is restricted to consideration of school environment.

School-Level Environment

Various writers have found it useful to distinguish classroom or classroom-level environment from school or school-level environment, which involves psychosocial aspects of the climate of whole schools (Anderson, 1982; Fraser & Rentoul, 1982; Genn, 1984). Nevertheless, despite their simultaneous development and logical linkages, the fields of classroom-level and school-level environment have remained remarkably independent. Consequently, it is common for workers in one field to have little cognizance of the other field and for different theoretical and conceptual foundations to be used to underpin the two areas. It is acknowledged here, however, that it would be desirable to break away from the existing tradition of independence of the two fields of school and classroom environment and for there to be a confluence of the two areas.

A common way of viewing school environment is to consider it as something distinct from and more global than classroom environment. For example, whereas classroom climate might involve relationships between the teacher and his/her students or among students, school climate might involve relationships between teachers and their teaching colleagues, head of department and school principal. Similarly, while classroom environment is usually measured in terms of either student or teacher perceptions, school environment is assessed usually (but not exclusively) in terms of teacher perceptions.

School climate research owes much in theory, instrumentation and methodology to earlier work on organisational climate in business contexts (Anderson, 1982). This point is illustrated clearly by the fact that two widely-used instruments in school environment research, namely, Halpin and Croft's (1963) *Organizational Climate Description Questionnaire (OCDQ)* and Stern's (1970) *College Characteristic Index (CCI)*, relied heavily on previous work in business organisations. Consequently, one feature of school-level environment work which distinguishes it from classroom-level environment research is that the former has tended to be associated with the field of educational administration and to rest on the assumption that schools can be viewed as formal organisations (Thomas, 1976). Another distinguishing feature is that, whereas classroom-level research has been concentrated on secondary and elementary schools rather than in higher education, a sizeable proportion of school-level environment research has involved the climate of higher education institutions.

Assessment of School Environment

In the present study, teachers' perceptions of their school environment were assessed using a modified version of the *School-Level Environment Questionnaire* (SLEQ; Fisher & Fraser, 1991; Rentoul & Fraser, 1983). Separate actual and preferred versions of this instrument were administered to 64 teachers in the same 20 schools. Following item analysis of these data, two of the SLEQ's original scales and several individual items were omitted to form a 35-item version. The names of the scales in this version are listed in Table 3.

The SLEQ has been used in exploring differences between the climates of elementary and high schools (Fisher & Fraser, 1991) among a sample of the 109 teachers in 10 schools in Tasmania. The most striking pattern of findings was that the climate in elementary schools emerged as more favourable than the environment of high schools on most of the SLEQ scales. In particular, relative to high school teachers, elementary school teachers perceived their school climates considerably more favourably in terms of greater Affiliation, Professional Interest, Staff Freedom Participatory Decision Making, Innovation and Resource Adequacy. Also, the SLEQ was used successfully by teachers to assess their school environment and to use this information as a basis for improving their school environment (Fisher & Fraser, 1991).

TABLE 3. Internal Consistency Reliability (Alpha Coefficient), Discriminant Validity (Mean Correlation with Other Scales) and Ability to Differentiate Between Schools (ANOVA Results) for the School-Level Environment Questionnaire for Two Units of Analysis

Scale	No. of Items	Unit of Analysis	Alpha Reliability		Mean Correlation with Other Scales		ANOVA Results Eta^2
			Actual	Preferred	Actual	Preferred	Actual
Affiliation	6	Individual	0.94	0.50	0.53	0.35	0.75*
		School Mean	0.96	0.51	0.56	0.45	
Professional	7	Individual	0.93	0.63	0.50	0.48	0.77*
Interest		School Mean	0.96	0.73	0.52	0.53	
Participatory	7	Individual	0.78	0.52	0.45	0.40	0.69*
Decision-Making		School Mean	0.88	0.53	0.49	0.45	
Innovativeness	9	Individual	0.92	0.70	0.55	0.49	0.73*
		School Mean	0.95	0.73	0.56	0.59	
Resource	6	Individual	0.77	0.79	0.41	0.53	0.47*
Adequacy		School Mean	0.60	0.69	0.42	0.59	

* $p<0.001$
The sample consisted of 64 teachers in 20 schools.
Items 1 and 29 have been deleted.

Cross-Validation of SLEQ in Nigeria

Table 3 reports for the SLEQ validation information analogous to that reported previously in Table 1 for the classroom environment measures. Data are reported for two units of analysis – the individual teacher's score and the school mean score. The statistics reported are the alpha reliability (internal consistency), mean correlation of a scale with the other scales (discriminant validity) and ANOVA results for class membership differences (ability to differentiate between classrooms).

Generally the reliability figures are high for the actual form, but lower for the preferred form of the SLEQ, for the two units of analysis. The mean correlations suggest adequate discriminant validity but, clearly, these scales overlap. The ANOVA results confirmed the ability of each scale to differentiate significantly ($p<0.001$) between the perceptions of students in different classes.

Associations Between School and Classroom Environments

Table 4 reports associations between students' perceptions of classroom-level environment and teachers' perceptions of school-level environment. Simple correlations are reported for the sample of 20 school means.

TABLE 4. Correlations Between Classroom and School Environment Scales Using School Mean as Unit of Analysis

Classroom Environment Scale	Correlation with School Environment Scale				
	Affiliation	Professional Interest	Participatory Decision-Making	Innovativeness	Resource Adequacy
Negotiation	0.55*	0.61**	0.60**	0.60**	0.63**
Autonomy	0.57**	0.63**	0.a62**	0.61**	0.57**
Student Centredness	-0.04	0.01	0.07	0.02	0.06
Investigation	0.58**	0.62**	0.64**	0.60**	0.54**
Differentiation	0.22	0.21	0.17	0.18	0.27

* $p<0.05$
** $p<0.01$
The sample size was 20 school means.

It is interesting to note from Table 4 that all five dimensions of school-level environment (i.e., Affiliation, Professional Interest, Participatory Decision-Making, Innovativeness, and Resource Adequacy) appear to affect significantly the level of classroom Negotiation, Autonomy, and Investigation. On the other hand, none of the school environment

variables were related significantly to the amount of classroom Student Centredness and Differentiation.

Although little prior research has attempted to establish links between school-level and classroom-level environment, the pattern of results emerging from this study generally replicate two prior studies conducted in Australia using the SLEQ (Fisher, Fraser, Wubbels, & Brekelmans, 1993; Fraser & Rentoul, 1983).

Conclusion

The present study resulted in the development of some widely-applicable, valid and reliable instruments that can be used in future research on classroom and school environment in Nigerian schools. Also, the present finding of relationships between classroom environment and student outcomes specifically in agricultural science classes in Nigeria generally replicate numerous prior studies in other subject areas in several other countries. Also the research provides one of the few studies of associations between classroom-level and school-level environment. This study is distinctive not only because there has been little past research in the area of classroom environments in Nigeria, but also because research which specifically examines the environments of agricultural science classes has been nonexistent worldwide.

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